Vespa velutina launches into battle, will the European honey bee (*Apis mellifera iberica*) fight back?

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- Objectives

The present study will try to determine whether or not *A. mellifera iberica* will be able to effectively defend against the invasive *V. velutina*.

- Origin and expansion of the hornet *Vespa velutina*

- *V. velutina* is distributed in regions fromthe Indochinese peninsula to northern India, Taiwan and Indonesia, in climates with wide annual temperature range.
- In Europe: observed for the first time in 2004 in the department of Lot--et—Garonne, France.
- Strong pressure on the apiaries and important damages on the local honeybees population.
- It has economical and environmental costs, as the pollination of many crops depend on bees.

(Arca et al., 2009)

- *Vespa velutina* in Catalonia

- Theorized potential arrival since 2006.
- First individuals detected in 2012 at L'Alt Emporadà.
- Months later the first hives were found empty in la Vall d'Aran.
- During the 2013 it's presence has been confirmed in 3 more regions, La Selva, Osona and la Garrotxa (Fig.1).
- Experts contemplate an increasing expansion during the next years.

(Pujade-Villar et al., 2005)

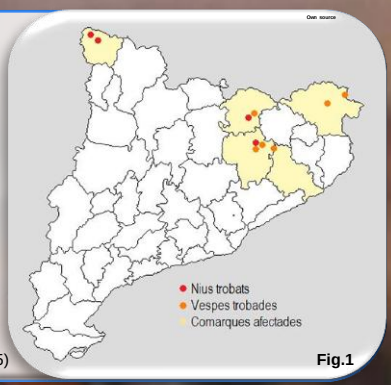

Fig.1

- Predatory behaviour of the Asian hornet

- At the hive:

1. Stationary flight facing the hive (wasp--hawking) at 30-40 cm from the entrance (Fig.2).
2. If the bee colony is to weak and it's unable to oppose resistance, the hornet tries to enter into the hive (Fig.3).

- Interception of the bees at the hive:

1. The hornet carries a captured bee towards a nearby shrub (it clings to a branch) and makes a flesh pellet (Fig.4).
2. The abdomen is thrown to ground and legs are cut one after the other. Only the nutrient-rich thorax is kept carried to the hornet's hive.

(Arca et al., 2009)


Fig.2


Fig.3


Fig.4

- Attacker- retreater defensive strategies of honeybees

- They consist in a group of different strategies the bees adopt when confronting or discovering wasps near the hive.
- The attacker strategy behaviour is common among different species of the *Apis* genus.
- These colonies have huge entrances (Fig.5a), and in presence of wasps the number of guard bees increases rapidly and they fiercely attack the hornets, killing them by either Heat or Asphyxia balling.
- On the other hand, the retreater colonies present smaller entries to the hive (Fig.5b) and, in case of encountering a hornet, they retreat to the entrance, forming a defensive line on it.
- It has been observed that no strategy has proved to more effective than the other.

(Papachristoforou, 2010)


Fig.5a
Fig.5b


Fig.7

- Heat balling technique

- The most studied *Apis sp*. defensive technique, common among different species of the genus.
- When attacked, several worker bees engulf the wasp in a ball (Fig.6).
- The hornet is killed by suffocation due to rising of the core temperature of the ball over the *V. velutina* lethal temperature (45.7±0.48ºC).
- The technique is highly cost effective for the bee colony.

(Tan et al., 2005)

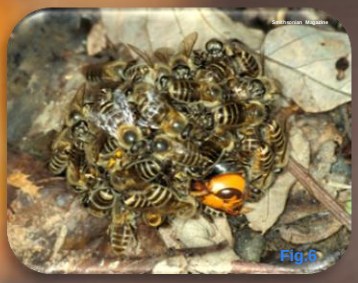
Fig.6

- Asphyxia balling technique

- Similar to the heat balling technique, but present only in the Cyprus honey bee, *Apis mellifera cypria,* against the *Vespa orientalis.*
- In both techniques the wasp is engulf in a bee ball, but unlike the *V. velutina*, the *V. orientalis* lethal temperature (50.6 ± 0,6ºC) is under the ball's core temperature (44 ± 0,5 ºC).
- To kill the hornet then, the bee ball compresses the wasp's abdomen to it's maximum (Fig.7), inhibiting the breathing capacity of the hornet, killing it by CO_2 accumulation in the hemolymph.

(Papachristoforou, 2010)

- Conclusions

- As *V. velutin*a has recently entered Europe, so there's a lack of information of the interaction with *A. mellifera.*
- Nevertheless, *A. mellifera* has been shown to have the potential to work out successful defensive techniques, like the Heat ball.
- In addition, the co-evolution with *Vespa cabro* may have predisposed *A.m. iberica* to be able to counter-attack in a short period of time.
- We can conclude then that *A.m.iberica* will be able, after an adaptation period, to resist to the newly introduced *V. velutina.*

- **Bibliography**

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